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MINISTRY OF
AGRICULTURE, FISHERIES AND FOOD

Food Standards Committee Report on Emulsifying and Stabilising Agents

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Recommendations relating to the use of
Emulsifying and Stabilising Agents
in Foods

LONDON
HER MAJESTY'S STATIONERY OFFICE
1956

NINEPENCE NET

Food Standards Committee

The Food Standards Committee was appointed by the Minister of Food in 1947 with the following terms of reference:

To advise the Ministers of Food and Health and the Secretary of State for Scotland as to the provision to be made concerning the composition of foods (other than liquid milk) and the labelling or marking of any foods for which such provision is made, by:

(*a*) Statutory Orders under the Defence (Sale of Food) Regulations; or

(*b*) Regulations (other than Milk and Dairies Regulations) under the Food and Drugs Acts, and corresponding enactments relating to Scotland;

for preventing danger to health, loss of nutritional value or otherwise protecting purchasers.

The members of the Food Standards Committee are:
Norman C. Wright, Esq., C.B., M.A., D.SC., Ph.D., F.R.I.C. (*Chairman*).
G. G. Barnes, Esq., C.B.E. (*Vice-Chairman*).
C. A. Adams, Esq., C.B.E., B.SC., F.R.I.C., Barrister at Law.
N. R. Beattie, Esq., M.D., D.P.H.
Professor S. J. Cowell, M.B., F.R.C.P.
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J. M. Johnston, Esq., M.D., M.R.C.P.B., F.R.C.S.(Ed.), F.R.S.E.
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A. Propper, Esq., M.B.E.
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G. Taylor, Esq., O.B.E., F.R.I.C.
R. F. Tyas, Esq.

Joint Secretaries:
M. D. M. Franklin, Esq.
W. M. Shortt, Esq., M.SC., F.R.I.C.

Preservatives Sub-Committee

The Preservatives Sub-Committee was appointed by the Food Standards Committee in January, 1951, with the following terms of reference:

To review the Public Health (Preservatives, etc. in Food) Regulations and to make any recommendations the Sub-Committee may consider desirable for the amendment of the Regulations.

The members of the Preservatives Sub-Committee are:
Sir Charles Dodds, M.V.O., M.D., D.SC., F.R.C.P., F.R.I.C., F.R.S. (*Chairman*).
C. A. Adams, Esq., C.B.E., B.SC., F.R.I.C., Barrister at Law.
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Joint Secretaries:
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Ministry of Agriculture, Fisheries and Food
Food Standards Committee
Report on Emulsifying and Stabilising Agents

The Food Standards Committee have considered and adopted a Report by their Preservatives Sub-Committee on the use of emulsifying and stabilising agents in foods. The Report is in the following terms:—

1. We were appointed as a Sub-Committee of the Food Standards Committee in January, 1951, to:

> " Review the Public Health (Preservatives, etc. in Food) Regulations and make any recommendations considered desirable for the amendment of the Regulations."

2. Because of the wide range of substances covered by our investigations, we decided to issue a series of reports. Reports on antioxidants and colouring matters have already been published. The present report deals primarily with emulsifying and stabilising agents, i.e. substances capable of facilitating the uniform dispersion of oils and fats in aqueous media, or vice versa, and of stabilising such emulsions. Many of the substances submitted to us are both emulsifying and stabilising agents and are used in food for both purposes. Other substances have been put forward because they possess emulsifying or stabilising properties though they are in fact added to some foods primarily because they have different properties, e.g. the ability to enhance the palatable life of bread and flour confectionery (the so-called "crumb-softening" agents), the ability to produce a froth or in other cases to break down an undesirable froth, the ability to produce a plastic consistency or to reduce the spattering of heated fats. We have therefore considered all such uses and, while as a matter of convenience we use the single term "emulsifying agent" in this report, we intend our recommendations to extend to the use of emulsifying agents in food for these other purposes. On the other hand, certain of the substances we have considered are used as common ingredients of many foods in larger amounts than would be occasioned by their use as emulsifying agents, or in other cases are capable of being used in place of food ingredients such as fat and eggs.* Such uses fall outside the scope of this report and of our recommendations as to the use of substances as emulsifying agents.

3. A number of substances about which we have received representations would not appear to be properly considered as emulsifying agents within the scope of our enquiry. Our views on the use of these substances are contained in Appendix A.

Historical Introduction

4. Emulsifying agents were not amongst the substances considered by the Departmental Committee set up in 1923 to consider the use of preservatives and colouring matters in foods, and except for the prohibition on thickening substances in cream† there are no specific regulations governing their addition to foods.

5. In a memorandum submitted to the Ministers of Food and Health in 1950, a Joint Committee of the Society of Public Analysts and the Society of Chemical Industry recommended that the addition of, *inter alia*, emulsifying agents, and stabilising agents, should be brought under control.

6. Emulsifying agents when they were first used were few in number and were either natural substances such as gums and soaps or synthetic substances of

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*Referred to again in paragraph 35.

†Regs. 4 & 11 of the Public Health (Preservatives, etc. in Food) Regulations 1925-53.

comparatively simple constitution. The variety and characteristics of the emulsions which could be formed with these agents were of necessity limited, and the emulsions were not always stable. The substances of natural origin were frequently of variable performance. Progress in chemical synthesis has now made available a large number of new products with characteristics suitable for virtually every requirement.

The Use of Emulsifying Agents

7. Appendix B contains a list of the organisations which have given written or oral evidence to the Sub-Committee. The following paragraphs summarise the present-day usage in this country of emulsifying agents as revealed in evidence submitted to the Sub-Committee and indicate the representations we have received as to other substances which should be permitted or considered.

8. Edible gums, agar and other products of natural origin are widely used in the *bakery trades* mainly as stabilisers. Dried egg albumen (up to 11 %) and cellulose ethers (about 2%) are used to produce the characteristic texture of meringues, marshmallows, etc. Lecithin is used for crumb softening in bread and confectionery as well as for stabilising purposes. Glyceryl monostearate (G.M.S.) and other super-glycerinated fats* are also widely used for their crumb softening effect and to improve the texture of bread (up to 0.3 %). Polyoxyethylene stearate (P.O.E.S.) appears to be in use to a limited extent in some forms of bread and flour confectionery. Some of these substances are used in the preparation of imitation cream.

9. It was represented that the use of diacetyl tartaric acid esters of monoglycerides and stearyl tartrate should also be permitted. Neither is at present in use in the bakery trades in this country but the former is permitted as an optional ingredient in bread in the U.S.A. and the latter is held to have important properties in bread-making in improving gas retention in the dough during baking and hence crumb texture, and to be functionally superior to G.M.S. in that less is required to achieve the desired result.

10. Polymerised oil, usually made from soya bean oil, is used in some tin-greasing emulsions. Silicone resins are also used to a limited extent; they are applied as a lacquer and obviate the need for repeated tin-greasing.

11. An emulsifying agent and a stabiliser are stated to be essential in the making of *ice cream*. The usual emulsifying agent is G.M.S. but lecithin is also used. Gelatin, alginates, Irish moss and edible gums are the usual stabilisers. Cellulose derivatives are also used in both ice cream and ice lollies. Mono- or di-glyceryl laurate is used in the production of Parev (kosher) ices which do not contain animal fat. The emulsifying agent accounts for about 0.5 % and the stabiliser for not more than 1 % of the finished product. A few manufacturers add a small amount of calcium lactate or the sodium salts of citric, phosphoric or tartaric acids in the production of ice cream. Sodium phosphate has become more widely used in the manufacture of ice lollies during recent years.

12. *The oils and fats industry* makes use of emulsifying agents in the production of margarine. Those most widely used are lecithin and the mono-glycerides of fatty acids, the type of mono-glyceride varying with the effect desired. Lecithin

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*Although pure mono-glycerides are now available, the commercial products are usually mixtures of mono- and di-glycerides of fat forming fatty acids, with some tri-glycerides. For instance, commercial "G.M.S." seldom contains more than 40 % of glyceryl monostearate. In this report, we use the term "super-glycerinated fats" in its widest sense to cover any mixture of mono-, di- and tri-glycerides of fat forming fatty acids.

also has anti-spattering properties, and is said to impart a pleasing brown colour to food baked or fried in margarine. Up to five per cent of these substances may be used, but the normal amount is much less. Mono-glycerides are sometimes used in shortenings as well as in margarine, occasionally with the addition of a very small amount of sodium or potassium stearate to enhance the emulsifying effect. Polyoxyethylene derivatives and polyglycerol esters of fatty acids are not known to be used in margarine or compound cooking fats in this country.

13. Our attention has also been drawn to the use in some countries of polymerised oils and sodium sulphoacetates of mono-glycerides. The former is used in the manufacture of margarine on the Continent and the latter is a permitted ingredient of margarine in the U.S.A., but neither is at present used in margarine in this country.

14. A number of the natural substances which are in use in the *chocolate and sugar confectionery trades* as major ingredients in many products are also used in confectionery products as emulsifiers and stabilisers. In addition, other emulsifying agents are sometimes used. Partially hydrolysed proteins are used as foaming agents in the production of e.g. nougat and marshmallow. G.M.S. and super-glycerinated fats are used (up to about 1%) as emulsifying agents and stabilisers; they assist in the making and improve the eating quality of certain confections. A synthetic phospholipid is in use as a supplement to lecithin in chocolate manufacture. The industry also uses sorbitol to prevent the drying out of certain products. Cellulose ethers are also used to a very limited extent. It has been represented to us that provision should be made for the possible future use of other substances, such as the sorbitan fatty acid esters and polyoxyethylene derivatives, which are not at present in use.

15. The use of G.M.S. for emulsifying and cellulose derivatives for stabilising and thickening purposes is considered to be essential in the manufacture of *flavouring compounds*. The polyoxyethylene derivatives and the sorbitan fatty acid esters are not in general use in this country though they are said to be widely employed in the U.S.A., and it has been urged that their use should be permitted.

16. In the manufacture of *soft drinks*, brominated vegetable oils are extensively used to keep the flavour dispersed; not more than 200 p.p.m. would be present in the drink as consumed. A foaming agent is essential in the production of certain kinds of soft drinks; special grades of saponin and quillaia have been traditionally used.

17. Among *other food trades*, G.M.S. is a widely used emulsifying agent. It is normally used in amounts ranging from 0.1% to 1% and is added to products like cake mixtures and imitation creams. The phosphate, bicarbonate and citrate of sodium have long been used as processing aids in the manufacture of milk powder, evaporated milk, sterilised cream and processed cheese. Sodium alginate and cellulose derivatives are used for stabilising and thickening purposes in products like imitation cream and sauces. During recent years, a silicone antifoaming agent has become available for use in food, e.g. in the preparation of caramel colour and concentrated fruit juices.

Representations

18. In addition to the above evidence from the food industry as to the usage of emulsifying agents, we have received certain other representations. In general, food manufacturers are opposed to a permitted list of substances for use as emulsifying agents. In their view it is only necessary to prohibit the use of those substances shown to have harmful effects; other substances should be freely

permitted whether or not they are at present in use in this country, otherwise technological progress will be hampered. They point out that, with a permitted list, the need to make special application for new substances to be approved inevitably means that the fruits of individual enterprise to improve a product or a technique are made available to competitors. They urge that if a permitted list is nevertheless decided upon it should be made possible for new materials shown to be unobjectionable to be added to the permitted list within a reasonably short time.

19. It was suggested to us by representatives of the baking industry, including the British Baking Industries Research Association, that it would be proper to adopt a more careful attitude in the selection of emulsifying agents for use in bread than in other bakery products.

20. Representations have been made to us on behalf of a number of chemical manufacturers giving the composition of the commercial emulsifying agents they manufacture and details of pharmacological tests where these have been carried out. Many of the substances developed and widely used in the U.S.A. are now made, or are available, in this country.

Classification of Emulsifying Agents

21. The substances brought to our attention as in use or capable of being used as emulsifying agents thus cover a diverse range from common substances such as starches and gums to highly complex synthetic chemicals such as the polyoxyethylene compounds.

22. For products of natural origin and those such as hydrolysed protein and modified starch, we have not considered it necessary to carry out a detailed pharmacological assessment because many are natural constituents of certain foods and others are common ingredients apart from their use as emulsifying agents. For this reason it would be unrealistic to regard them simply as emulsifying agents, and to prohibit or permit their use solely for the purposes coming within the scope of this report. We therefore recommend that any statutory definition of "emulsifying agents" for the purpose of regulating the use of such substances should specifically exclude the following:

> agar, alginic acid, calcium and sodium alginates, carrageen, edible gums, dextrin, sorbitol, pectin, sodium and calcium pectate, "emulsifying salts" (sodium citrate, phosphates and tartrate), calcium lactate, lecithin, albumen, gelatin, quillaia, saponin, hydrolysed proteins, modified starches.

23. The remainder, which are listed in Appendix C, have been examined by the Pharmacology Panel of the Sub-Committee and classified as follows:

> *Class A.* Substances for which the available biological data indicate that their use in foods in the amounts customarily employed does not appear to present a health hazard.
>
> *Class B*(i). Substances which, judged on their chemical formulation, do not seem likely to present a health hazard if used in food but in respect of which the biological data, though consistent, are not sufficiently comprehensive to justify their classification as "A".
>
> *Class B*(ii). Substances which must at present be regarded with some suspicion either because the biological data are inadequate or conflicting or because the precise chemical composition is not known with certainty.
>
> *Class C.* Substances the biological data relating to which, or the chemical formulation of which, indicate that their use in food is likely to present a health hazard.

24. On the evidence available, no substance has been put into Class C, a group reserved for substances which present such a health hazard that their use in food could not be allowed. The sub-division of Class B into B(i) and B(ii) indicates where the presumption is respectively against or towards the use of the substance possibly involving some health risk.

25. The Sub-Committee endorse the classifications recommended by the Pharmacology Panel. In view of the possible risk attaching to the use of substances classified B(ii), the Sub-Committee consider that until such time as convincing data as to their freedom from health hazard are available, their use in food could not be recommended. Further consideration is therefore restricted to those substances which have been classified A or B(i).

The Case for a Permitted List

26. Our general view is that it is not in the public interest for chemical substances to be added to food unless there is adequate evidence that their use in food will not affect adversely the health of the consumer and a strong case can be made out that their use in food would have advantages, economically, technically or otherwise, likely to benefit the consumer.

27. All the substances dealt with in this report have value as processing aids or serve to improve palatability or impart a particular texture to food; without them it would be impossible to make many composite foods and soft drinks in the form to which the public have grown accustomed. We are satisfied that many of the substances present no health hazard in the small quantities normally consumed. On the other hand, there are others where the data available to us does not wholly free them from suspicion and, until such time as conclusive favourable evidence becomes available, we would not feel justified in recommending that they should be permitted. Such considerations lead us to the opinion that the number of substances used in foods for the purposes coming within the scope of this report should be no more than is consistent with the reasonable needs of industry and that control can best be exercised by prescribing a list of permitted substances.

28. The arguments in favour of this course are similar to those which led us to recommend the adoption of a permitted rather than a prohibited list in our earlier reports on antioxidants and colouring matters. Because of the diverse range of substances which are now under consideration and the constant development of new substances and new uses, we would particularly emphasise the importance of ensuring that new substances are not added to food until their freedom from health hazard has been adequately demonstrated. The task of safeguarding the public interest will be very difficult if manufacturers are free to employ new substances before appropriate pharmacological investigation has established their suitability for use in food. The method of prohibiting specified substances entails risk to the community since a potentially harmful ingredient could conceivably be in use for a considerable period before there was sufficient information available to warrant its addition to the prohibited list. The use of a permitted list removes this dangerous possibility and, in this respect, places all manufacturers on an equal footing. Furthermore, we have had in mind Section 4 of the Food and Drugs Act, 1955, which requires Ministers to "have regard to the desirability of restricting, so far as practicable, the use of substances of no nutritional value as foods or as ingredients of foods". This obligation seems to us to strengthen the case for a restricted list.

29. The emulsifying agents at present in use in this country appear to be relatively few in number despite the wide range of substances about which we have received representations. Many of the synthetic substances submitted for our consideration, although they have been used for some time in the U.S.A., are still only being used in a very limited way, if at all, in this country. This may possibly be due to doubt as to whether these substances fall within the scope of the Public Health (Preservatives, etc. in Food) Regulations or it may be because manufacturers are not fully convinced of their harmlessness or superiority over traditional products. On the other hand, it has been represented to us that some of the newer classes of substances could in fact meet all possible requirements of the food industries. We do not wish to proscribe harmless substances which have customarily been used in food or unnecessarily to hamper improvements through the use of newer substances which would be to the benefit of the public. We therefore make the following recommendations regarding the substances to be included (subject to the restrictions proposed in the following section) in a "permitted list" of emulsifying agents for use in food.

30. First, we consider that the following substances, which are already in use in this country, should be permitted:

- super-glycerinated fats
- synthetic lecithin
- propyleneglycol alginate
- propyleneglycol stearate
- methyl cellulose
- methyl ethyl cellulose
- sodium carboxymethyl cellulose

31. Secondly, we see no objection to including in the list the following substances, which are not known to be in general use in this country at present but about which we have received representations, and which we have classified A or B(i):

- stearyl tartrate
- diacetyl tartaric acid esters of super-glycerinated fats
- monostearin sodium sulphoacetate
- sorbitan esters of fatty acids

32. Thirdly, we consider that provision should be made so that in the future other substances may be permitted in substitution for, or in addition to, the substances which on present evidence we propose should constitute the permitted list. The procedure to be adopted is a matter for the Departments concerned, but we suggest that the basis for consideration should be the criteria set out in paragraph 26.

Restrictions on the foods to which permitted substances may be added

33. We are in complete agreement with the view (see paragraph 19) that the use of emulsifying agents in bread requires special consideration. Bread is consumed in substantial quantities by all sections of the community and the intake of an additive in bread will be greater and more continuous than when it is used in other foods. We therefore recommend that only super-glycerinated fats and stearyl tartrate should be permitted for use in bread. Super-glycerinated fats closely resemble natural products. The pharmacological evidence indicates that stearyl tartrate is free from health hazard.

34. We do not consider that emulsifying agents should be added to milk for sale as such, but we see no objection to the practice of using certain of them as processing aids in the manufacture of evaporated milk, milk powder and other dairy products.

35. The use of thickening agents in cream is already prohibited in the Public Health (Preservatives, etc. in Food) Regulations and we consider that a similar prohibition should be continued in respect of cream and reconstituted cream. We are not aware of any other foods where the use of emulsifying agents might mislead the public by making a food appear of better quality than is actually the case. The possibility that some of these substances might be used as "fat extenders" or in substitution for eggs, as they were during conditions of wartime scarcity, has already been mentioned. While such uses may have been defensible in those conditions, and while there may be special circumstances in which a low-fat diet is required, the public would normally not expect the amount of fat and eggs used in compounded foods to be reduced or replaced by the use of emulsifying agents. We consider that the position would be safeguarded by the terms of the regulations we propose for the use of emulsifying agents and by the provisions of the Food and Drugs Act and the Labelling of Food Order.

The Case for limiting the amount to be used

36. It has been generally represented to us that it is not necessary to restrict the amount of emulsifying agent which may be used in foods. Most of these substances are expensive and manufacturers will be concerned to use only enough to achieve the desired result. There is, moreover, generally an optimum amount, which is usually small, beyond which there does not appear to be any advantage to be gained; an excess amount may even detract from the effect desired. In these circumstances we do not consider it necessary or practicable to specify limits, but would stress that the amount used should always be the smallest quantity consistent with the best commercial practice.

Specifications of Composition and Purity

37. Many of the emulsifying agents that may be permitted in food have other industrial uses for which the standards of purity required may not be adequate for the substances when they are to be used in foods. We consider it important that high standards of purity consistent with their use in food should be secured and we therefore recommend that, in consultation with the interests concerned, specifications of composition and purity should be drawn up for the substances it is proposed to permit for use in foods as emulsifying agents.

Labelling

38. We do not consider it necessary to make special provision for the declaration of the presence of emulsifying agents in foods. Where the use of these substances could mislead the consumer, we have recommended a special restriction (paragraph 35); apart from this, the general provisions of the Labelling of Food Order secure that the use of these substances will be disclosed by their appropriate designation in pre-packed foods subject to the relevant provisions of the Order. In this connection, we see no objection to the existing provision that sodium citrate, sodium phosphates and sodium tartrate may be designated as "emulsifying salts" without further specification when used singly or in admixture as ingredients of food.

39. When emulsifying agents are offered for sale we consider that, in addition to any trade name, the chemical nature of the product and an indication that it is of the necessary purity for use in food should be given. Descriptions implying that the substances are substitutes for fat or eggs should not be permitted.

Enforcement

40. We recognise that enforcement of specifications of purity for permitted emulsifying agents will only be possible on the products before their incorporation in foods. The detection of emulsifying agents in foods may present some difficulties but, with the development of modern analytical techniques, we are satisfied that problems of enforcement need not stand in the way of controlling the use of these substances in the interests of the public.

Summary of Recommendations*

41. The following are our recommendations:

(i) that the addition to foods of emulsifying and stabilising agents as defined in paragraph 2 should be subject to statutory regulations;

(ii) that, except for the common substances enumerated in paragraph 22, official approval to the use of such agents should be restricted for the present to the substances specified in paragraphs 30 and 31;

(iii) that, in the case of bread, approval should be restricted to permit only the addition of super-glycerinated fats and stearyl tartrate;

(iv) that the addition of emulsifying agents to milk and of thickening agents to cream should be prohibited;

(v) that specifications of composition and purity should be prescribed for each of the permitted substances;

(vi) that emulsifying and stabilising agents sold for use in food should bear a statement of their chemical nature in addition to any trade name and indicate that they are suitable for use in food.

FSC/PVT/REP.5 July 1956

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*The Sub-Committee's views on certain substances on which evidence was received but which they consider should not be classified as emulsifying and stabilising agents are given in Appendix A.

Appendix A

Views of the Sub-Committee on substances submitted to them which they consider should not be classified as emulsifying agents or emulsion stabilisers

Brominated Oils

1. Brominated oils from olive, peach and apricot kernel, soya, sweet almond and other vegetable oils have for long been used as "weighting oils" to stabilise emulsion flavours for use in soft drinks. Their use is permitted in the U.S.A. and South Africa. The maximum amount likely to be used for this purpose is well below the level at which any bromide released would have adverse effects, and we would see no objection to the continued use of brominated edible vegetable oils in soft drinks and flavouring compounds used in the preparation of soft drinks.

Polymerised Oils

2. Polymerised oils have been classified B(ii) and are therefore not included in the permitted list for use in food. But they are also used in the baking industry (see paragraph 10 of the report) in the form of an emulsion for tin-greasing. The amount likely to be transferred to the food when used in this way is extremely small and we would see no objection to their use for this purpose.

Silicones

3. Of the two silicone products which have been represented as being used in the food industry, one, a methylpolysiloxane, is used to suppress undesirable foaming in certain food manufacturing processes, and the other, a silicone resin —methylphenylpolysiloxane—is used in the baking industry in place of a greasing agent. It is heat-cured on to the baking tin forming a semi-permanent glaze which obviates the need for repeated tin-greasing.

4. As the silicone anti-foam agent has been classified B(i) and it appears to be an effective processing aid we see no reason why its use for this purpose should not be permitted. The U.S. Food and Drug Administration have expressed the view that no objection need be taken to the use of this substance provided not more than 10 p.p.m. is present in the finished food. Unlike many emulsifying agents (see paragraph 36) there is some risk that excessive amounts could be used and we consider that a limit in this case would be desirable. From information submitted to us, it would appear that for all projected uses a limit of 10 p.p.m. on the finished food would be reasonable. In line with our recommendation on emulsifying agents, we do not think this substance should be added to milk.

5. The methylphenylpolysiloxane resin for use as a tin glaze is practically insoluble when it has been heat-cured on the tin. It has been classified B(i). We see no objection to its use for this purpose and since the amount which might conceivably be taken up by the food would be so small as to be insignificant there appears to be no necessity for a limit to be specified.

Appendix B

Written statements or representations have been received from the following organisations and other interests concerned with the use of emulsifying and stabilising agents in food.

Abril Corporation (Great Britain) Limited
Alginate Industries Limited
Association of British Chemical Manufacturers
*Association of Manufacturers of Shortening and Compound
Alfred Bird and Sons Limited
*Allied Bakeries Limited
*British Arkady Limited
British Bakels Limited
*British Baking Industries Research Association
British Celanese Limited
*British Essence Manufacturers' Association
British Soya Products Limited
*W. J. Bush and Company Limited
*Cocoa, Chocolate and Confectionery Alliance Limited
Crimony Company Limited
Emulsion A/S. Copenhagen
*Flavouring Compound Manufacturers' Association
*Food Manufacturers' Federation Incorporated
Hardman and Holden Limited
Honeywill-Atlas Limited
*Ice-Cream Alliance Limited
Imperial Chemical Industries Limited
C. M. Keyworth and Company Limited
*Margarine Manufacturers' Association
Midland Silicones Limited
*National Association of Creamery Proprietors and Wholesale Dairymen
National Association of Soft Drinks Manufacturers Limited
Pettingill Products Limited
Rex Campbell and Company Limited (on behalf of Glyco Products Co. Inc. New York)
Society of Medical Officers of Health
*Unilever Limited
*Wholesale Ice-Cream Federation

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*These organisations also gave oral evidence.

Appendix C

Emulsifying agents and other substances considered by the Pharmacology Panel

1. The substances considered may be grouped according to chemical composition as follows:

Group I	esters of (*a*) alcohols, (*b*) glycols, (*c*) glycerol, (*d*) pentaerythritol, (*e*) hexitol, (*f*) polyglycols, (*g*) polyglycerol. polymerised oils
Group II	cellulose derivatives
Group III	brominated oils
Group IV	silicones

2. The substances submitted under Groups III and IV are not emulsifying agents and their use in food is discussed in Appendix A.

3. Each group may contain a large number of individual substances. In Group I, for example, the possible combinations of a particular hydroxy compound with organic acids are many. Some of the commercial products are themselves mixtures; for example, the so-called hexitan esters appear to consist of a mixture of the mono-, di- and tri-fatty acid esters of hexitol and its anhydrides. With polymerised compounds such as polyglycol esters, the polyol part of the ester is a complex mixture of polymers. For these reasons it is seldom prudent to give an overall classification to a group as a whole.

4. When considering the potential health hazard it is necessary to have regard not only to the toxicity of the compound itself but also to that of the products of metabolism.

5. By far the most widely used substances are the partial fatty acid esters of glycerol—the "super-glycerinated fats"—which on digestion are split into glycerol and fatty acid in the same way as ordinary fats (triglycerides). There would seem to be no reason to be suspicious of these esters as a class.

6. The same considerations do not apply to other substances the constituents of which are foreign to the human system, and each substance must be considered on its merits.

7. It would appear that, with the exception of propylene glycol, the toxicity of the glycols renders them unsuitable for use in foods. The toxicity of the polyglycols tends to decrease with increase in the mean molecular weight. The polyol moiety of the fatty acid esters is stated not to be metabolised. No information has been submitted to us on the metabolic fate of the polyglycerol esters. The cellulose ethers and derivatives are metabolically inert, and pass through the digestive system unchanged.

8. The following table gives the classification assigned to the substances concerned on the basis of the information available to us as to composition and biological tests.

9. The Pharmacology Panel wish to acknowledge their indebtedness to Professor Boyland for advice on carcinogenicity.

Group	Substance	Panel Classification	Remarks
Ia	Stearyl tartrate	A	Classification based on results of unpublished pharmacological tests.
Ia	Lauryl sulphate	B(ii)	
Ia	Sodium dioctylsulphosuccinate	B(ii)	
Ib	Propylene glycol alginate	B(i)	
Ib	Propylene glycol stearate	B(i)	No data submitted, but no reason to expect this substance to be toxic.
Ic	Super-glycerinated fats	A	Classification based on data for glyceryl monostearate but applies also to the mono- and di-glyceryl esters of other fat-forming fatty acids.
Ic	Diacetyl tartaric acid esters of super-glycerinated fats	A	Diacetyl tartaric acid esters of mono-glycerides are allowed in the U.S.A. in bread. No reason to suspect these substances to be harmful.
Ic	Monostearin sodium sulphoacetate	A	
Ic	Synthetic lecithin	A	Classification based on a confidential report on pharmacological tests.
Id	Pentaerythritol mono- and di-stearate	B(ii)	More biological data are desirable.
Ie	Sorbitan esters of fatty acids	B(i)	Commercial products probably contain some di- and tri-esters of sorbitol and its anhydrides; classification based on data submitted for the monostearate but applies to the group. On metabolism, these esters are split into fatty acids, which are utilised in the same way as fats, and the sorbitol which passes largely unchanged from the body.
If	Polyoxyethylene stearate	B(ii)	Series of products containing different proportions of ethylene oxide per fatty acid molecule are marketed under various proprietary trade names. Commercial products are probably mixtures of the mono- and di-esters and contain some free polyglycol. The precise composition is in doubt. The existing experimental data are conflicting. In 1953, the Food Protection Committee of the Food and Nutrition Board (U.S.A.) concluded that the data failed to demonstrate that P.O.E.S. was safe for use under all patterns of dietary consumption and for all segments of the population. Subsequent tests in which high levels were fed to experimental animals showed no adverse effects. Experiments are at present being carried out on a P.O.E.S. and a polyglycol sorbitan fatty acid ester manufactured in this country and the B(ii) classification is provisional pending the results of these experiments.
If	Polyethylene sorbitan monostearate	B(ii)	
Ig	Polyglycerol esters of fatty acids	B(ii)	Classification is provisional for group as a whole. More information is necessary on the precise composition of individual substances. Tests designed to ascertain whether they present any carcinogenic hazard are desirable.

Group	Substance	Panel Classification	Remarks
Ig	Polyglycerol esters of polymerised fatty acids	B(ii)	
I	Polymerised oils	B(ii)	
II	Methyl cellulose	A	Classification relates to the specially pure products sold for use in food.
II	Methyl ethyl cellulose	A	
II	Sodium carboxymethyl cellulose	A	
II	Sodium carboxymethyl galactomannose	B(ii)	Data inadequate.
III	Brominated edible vegetable oils	B(i)	Data submitted for brominated olive oil.
IV	Methylpolysiloxane	B(i)	These generic descriptions could embrace a large number of substances; the classifications are based on data for two products sold under trade names for anti-foaming and tin-glazing respectively. The classifications could relate to other silicones of similar composition and properties.
IV	Methylphenylpolysiloxane	B(i)	

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